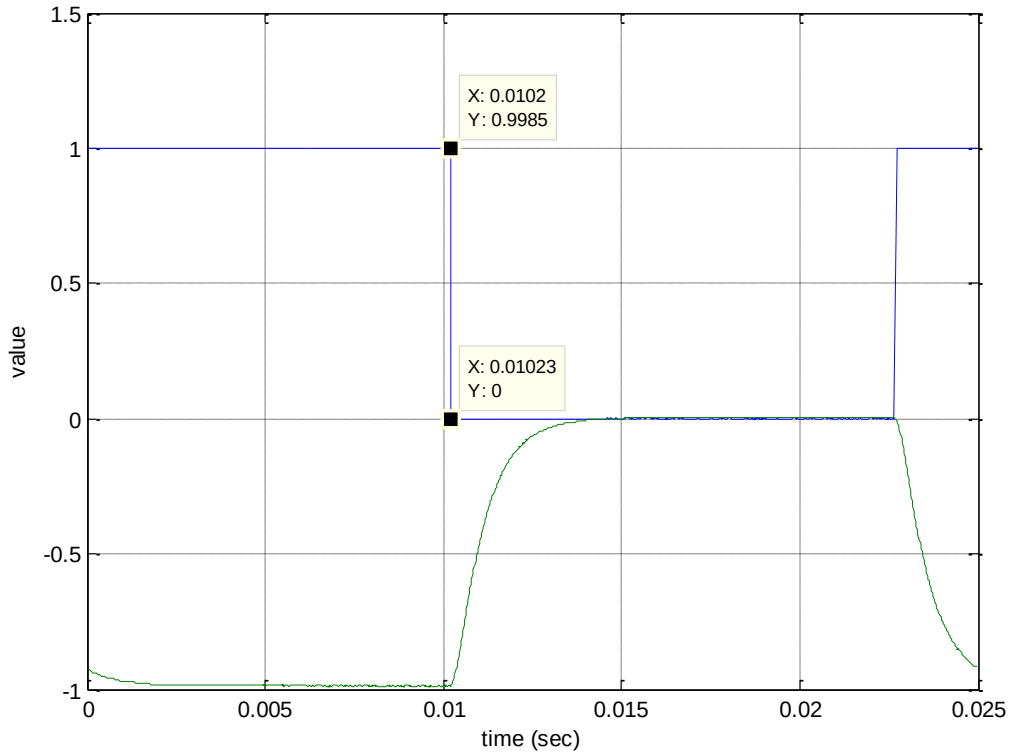
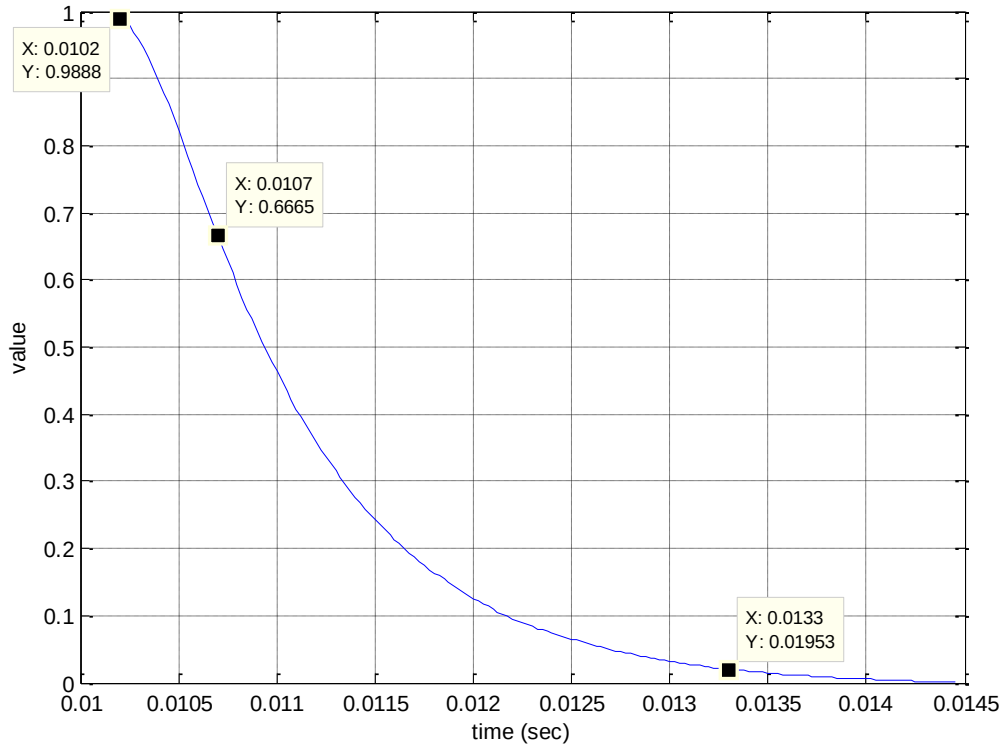
0304-543 MELVSS1 Overdamped Curve-fit Data Preview with scrutiny

Original data series as recorded via DAQ:



Data after sub-setting and inversion of values:



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```
%-- 11/29/12  4:14 PM --%
y_bkup=load('overdamped_data.dat');
plot(y_bkup(:,1),y_bkup(:,2:3))
ysub=0;
%ysub=y_bkup(409:579,:,:);
y=[ysub(:,1),-ysub(:,3)];
figure(2)
plot(y(:,1),y(:,2))
global y
x0=[0 0 0 0 1];
[xfinal,fval,y_est]=mhk_overdamped_curve_fit_n_matlab3a(x0,y);
figure(3)
plot(y(:,1),y(:,2),'o',y(:,1),y_est,'--','LineWidth',2)
x0adjusted=[1,-1000,1,-6667,0];
[xfinal,fval,y_est]=mhk_overdamped_curve_fit_n_matlab3a(x0adjusted,y);
figure(4)
plot(y(:,1),y(:,2),'o',y(:,1),y_est,'--m','LineWidth',4)
% save('ysubset3col_new.dat','ysub','-ascii','-tabs');
% save('ysubset2fit_new.dat','y','-ascii','-tabs');
```

```
% System Dynamics curve-fit algorithm using 'fminsearch' in MATLAB
% Mark H. Kempski, PhD.     Last modified: March 11, 2011 early PM
%
% Actual data must exist in the workspace as a 2-D array 'y'
%   where the 2-D array is predisposed to
%       y(:,1)= time vector and
%       y(;,2)=data vector to be fit
%
% The fit uses the initial guess vector 'x0', where
%       x0(1)=A, x0(2)=B, etc.
%   represent parameters in the output_estimate_eqn:
%       y_est=A*exp(B*(t-t0))+C*exp(D*(t-t0))+E
%
%Copy & paste the following line to run in workspace:
%   [xfinal,fval,y_est]=mhk_overdamped_curve_fit_n_matlab3a(x0,y);
%
%For easy plotting cut & paste:
%   plot(y(:,1),y(:,2),'o',y(:,1),y_est,'--','LineWidth',2)
%
function [xfinal,fval,y_est_vector]=...
    mhk_overdamped_curve_fit_n_matlab3a(x0,y)
clc
global y
t=y(:,1);
data=y(:,2);
options = optimset('Display','final','TolFun',1e-8);
[x,fval,exitflag,output]=fminsearch(@mhk_eqn_estimate,x0,options);
xfinal=x;
A=x(1);
B=x(2);
C=x(3);
D=x(4);
E=x(5);
y_est_vector=A*exp(B.*(t-t(1)))+C*exp(D.*(t-t(1)))+E;
return

function f=mhk_eqn_estimate(x)
% NOTE: here the vector 'x' contains the parameters to be optimized
% where for example: x(1)=A, x(2)=B, in the eqn y=A*exp(B*t)+C*exp(D*t)+E
global y
t=y(:,1);
data=y(:,2);
A=x(1);
B=x(2);
C=x(3);
D=x(4);
E=x(5);
y_est_vector=A*exp(B.*(t-t(1)))+C*exp(D.*(t-t(1)))+E;
sq_variance_vector=(data-y_est_vector).^2;
f=sum(sq_variance_vector);
return
```